

REMARKS

Applicants thank the Examiner for his time and consideration during the first telephonic interview of September 7, 2006, during which Applicant's representative and the Examiner discussed the cited references and the rejection of the pending independent claims, and during the second telephonic interview of October 2, 2006, during which Applicant's representative, and Inventor Michael H. Wright, and the Examiner together discussed the inventive features and technical aspects of the claims as compared to the prior art. During these interviews, the Examiner suggested that Applicants consider how to amend the claims to emphasize with more particularity what Applicants believe is the invention and also suggested that Applicants should file a Request for Continued Examination (RCE) to accompany the amended claims. In response, Applicants have included an RCE filed herewith and have made amendments to claims 28-34, 36-51, and 53-56 (claims 35 and 52 were the only claims not amended), and Applicants have further added new claims 57-68, all to provide further clarifying detail about certain aspects of Applicants' invention.

Nearly all of the amendments to the dependent claims were made to fix minor typographical and/or grammatical errors and to make the terminology used in the dependent claims more consistent with the terminology used in the independent claims, as amended. All the amendments made herein, including those to the independent claims 28, 45, and 56, are supported throughout the application as filed, especially at page 13, lines 4-15, page 14, lines 19-22, page 15, lines 5-17, page 19, lines 3-13, and page 20, line 6 through page 24, line 2. No new matter has been added.

The Prior Art Rejections

Claims 28-56 are rejected under 35 U.S.C. §103(e) over U.S. Patent No. 6,567,811 to Edwards ("Edwards") in view of U.S. Patent Publication No. 2002/0078296 to Nakamura et al. ("Nakamura").

Claim 28, as amended herein, recites:

A method for managing data that may be replicated from one or more volumes of data that are part of a first volume group on a first computer system having a first operating system, the method comprising the computer-executed steps of:

discovering logical information related to the one or more volumes of data that are part of the first volume group on the first computer system;

creating a map of the logical information to physical devices on the first computer system, the map comprising:

information identifying one or more devices associated with one or more physical volumes containing the data; and

- information providing definition and structured layout of volume groups, internal logical volumes and file systems on the first computer system;
- using the map to create a second volume group on a second computer system having a second operating system, where the logical configuration of the second volume group is substantially identical to the logical configuration of the first volume group; and
- using the map to reconstruct on the second computer system the internal logical volumes and file systems of the first computer system and mount a duplicate of the one or more volumes of data on the second computer system.

Applicants maintain that claim 28, as amended (and all claims dependent therefrom, namely claims 29-44 and newly added claims 57-61) is patentable over the cited art, taken either alone or in combination. Applicants contend that the cited references, taken alone or in combination, do not teach or suggest each and every limitation of claim 28, as amended herein. In particular, Applicants maintain that the cited references, taken alone or in combination, do not teach amended claim 28's recitations of **creating a map of the logical information to physical devices on the first computer system, the map comprising information identifying one or more devices associated with one or more physical volumes containing the data; and information providing definition and structured layout of volume groups, internal logical volumes and file systems on the first computer system; using the map to create a second volume group on a second computer system having a second operating system, where the logical configuration of the second volume group is substantially identical to the logical configuration of the first volume group; and using the map to reconstruct on the second computer system the internal logical volumes and file systems of the first computer system and mount a duplicate of the one or more volumes of data on the second computer system.**

Edwards mentions the creation of a filesystem map (col. 5, lines 55-67 and col. 10, lines 43-46), but the filesystem map Edwards creates is very different than amended claim 28's recitation of a map of logical information to physical devices, where the map includes identifying devices associated with volumes, including, **information providing definition and structured layout of volume groups, internal logical volumes and file systems on the first computer system**. As those of skill in the art appreciate, filesystem information is very different than volume group, physical volume, and logical volume level information. Even though file systems can be the same between two different operating systems, the volume definitions, volume groups, logical volumes, and other volume-level information is very different. That is why the invention as recited in claim 28, as amended, is useful in permitting a second computer system, even one running a second (different) operating system, to be able to

reconstruct on a second computer system a second volume group having the same logical configuration as the first volume group.

Edwards mentions in the above passages that the filesystem map is used to recreate the filesystem in the new volume group. However, Edwards does not teach or suggest that his filesystem map can be used to create a second volume group having a substantially identical logical configuration to that of the original volume group, and to reconstruct on the second computer system the internal logical volumes and file systems of the first computer system and mount a duplicate of the one or more volumes of data on the second computer system, as recited in claim 28, as amended. Edwards also does not teach or suggest that his filesystem map includes any information about **definition and structured layout of volume groups, internal logical volumes and file systems on the first computer system**.

As Applicants explained during the telephonic interviews, and as amended claim 28 shows, the map of claim 28, as amended, provides information at the volume level, including identification of the physical volumes associated with the volumes containing the data and information providing definition and structured layout of volume groups, internal logical volumes and file systems on the first computer system. **This enables the map effectively to “self describe” the physical layout of the physical devices, volume group, logical volumes, and file system existing in the first computer system to any other computer system that has access to the map.** Thus, a second computer system (regardless of the operating system it is running) can use the map recited in claim 28, as amended, to (a) create a second volume group on a second computer system that has an identical logical configuration to that of the first volume group and (b) reconstruct on the second computer system the internal logical volumes and file systems of the first computer system and mount a duplicate of the one or more volumes of data on the second computer system. The map of claim 28, as amended, and the logical information that it provides relating to the first computer’s source volumes, enables a second computer to take over in place of the first computer and to work with the copies of the data in the same manner as the original first source computer [see Applicants’ specification at page 4, line 20 through page 5, line 6].

Applicants further note, as to the rejection of claim 33 (which depends from claim 28) and the rejections of claims 34-44 (which all depend from claim 33), since neither Edwards nor Nakamura teaches anything relating to split or separated mirrors (as explained further herein), it is impossible for these references, taken alone or in combination, to teach establishing one or more mirrored copies and separation of the mirrored copies, as recited in claim 33-44, as amended.

As those of skill in the art understand and as Applicants’ specification clearly explains at page 13, lines 5-15, a mirrored copy, referred to in the map recited in claim 28 as amended, is not the same

thing a mere copy. A mirrored copy is a special type of copy that is capable of operating differently than a mere static identical copy of a source, because the mirrored copy is capable of continually “reflecting” back what is on the source, to stay synchronized with the source. For example, as described on page 13, lines 5-21 of Applicants’ specification, if data on the standard volume changes, the same changes are immediately applied to the mirrored copy, and mirrored copies can be synchronized in either direction (e.g., from standard disk to mirrored disk and vice versa). As further explained in Applicants’ specification at page 9, lines 16-19, such mirroring is useful because the mirror can allow access to production volumes (and the data in them) even while backup operations are being performed on the mirror’s source, and the mirrors that were accessed can later be used to synchronize the mirror’s source. As explained in Applicants’ specification at page 13, lines 4-21, page 17 line 10 through page 19, line 13, the mirrored copy can be separated (also referred to in Applicants’ specification as “split”) such that the mirrored copy is isolated from the primary and no further changes are applied to the mirrored copy from the point of the separation.

Even more importantly, as is clear from Applicants’ specification, a mirrored copy of a volume of data, especially on that has been separated from the volume of data, does not change the original (also referred to as primary) volume of data at all. When a mirrored copy is established or separated, the standard or primary volume that the mirrored copy is mirroring continues to exist and is not intentionally written over or destroyed (see Applicants’ specification at 13, lines 5-21; page 16, line 1 through page 17, page 19, line 19 through page 20, line 1). This is further shown in the language of claim 28, as amended, which recites that the one or more mirrored copies of data are copies of one or more volumes of data that are part of the first volume group on the first computer system(not “were” part of the first volume group). When the primary volume continues to exist, changes made to the primary can be applied to the mirrored copy up to the point of the separation, and the mirrored copy can be synchronized to the primary (or vice versa) before or after the separation (see Applicants’ Specification at page 13, lines 6-21).

In the Final Office Action’s rejection of claim 33, the Examiner had cited two passages in Edwards that allegedly teach establishing and separating/splitting a mirror. However, the cited passages (Edwards col. 10, lines 44-51) describe something very different and do not teach or suggest anything about mirrors or splitting them, especially when the text immediately before and after the cited passage is also included (see Edward at col. 10, lines 40-64, below, emphasis added):

FIG. 8 illustrates a flowchart depicting the process of merging volume groups in accordance with a preferred embodiment of the present invention. The process begins by creating a

filesystem map for filesystems on the disappearing volume group (step 802) A filesystem map maps the location of a logical volume (which contains the filesystem) in regards to its physical location on the disk. Next, the filesystems are unmounted, or made unavailable (step 804). The old filesystems, the arrangement of the logical volume on the physical drive, are then removed (step 806). The volume information in the original volume control block is then copied to a separate location (step 808). The logical volume control block is copied to a different location for recovery purposes, if needed. The original volume control block is zeroed out or written over (step 810).

Edwards clearly does not include anything to create, identify, or use any type of a mirrored copy of the volume, as required by claim 28 as amended. None of the copies of the volume being made in this passage of Edwards (i.e., the volume information in the original volume control block or the logical volume control block copied for recovery purposes) are taught or suggested to be mirrored copies. Edwards never teaches or suggest that the copy of the volume being made acts like or can serve as a mirrored copy. Furthermore, none of the copies made in Edwards could even serve as or be interpreted or inferred to be a mirrored copy, because the original volume control block is zeroed out or written over – there is nothing for these copies to mirror or be separated from. Because no mirrored copy is ever created of any volume, Edwards cannot possibly teach amended claim 28's recitation of a map that provides the physical locations of separated one or more mirrored copies of data, and mounting a duplicate of the mirrored copies of data on a second computer system having a second operating system.

Applicants note again that Edwards has a different principle of operation that teaches away from and differs significantly from claims 33-44 of the present invention. Edwards never teaches, suggests, or even mentions anything relating to mirroring or to any function related to mirroring (such as synchronizing the data in a copy with the data in an original when the original changes). Rather, Edwards relates to merging volume groups, such as by moving the original data or filesystem to a larger volume group, e.g., by reorganizing or rearranging volume groups, whereby the original volume group no longer exists and the result is only the new, merged/reorganized volume group (see FIG. 8 and col. 10, line 40 through col. 11, line 6 of Edwards). In numerous examples and Figures, Edwards makes it a point to show that it is merging two volume groups, with the original volume group being removed. For example, Edwards describes situations such as moving data to a larger volume group (Edwards at col. 5, lines 34-35), rearrangement and combination of UNIX data structures (Edwards at col. 5, lines 48-49), system reconfigurations (Edwards at col. 10, lines 29-30) and reorganization (see comment text in FIG. 9A of Edwards). In Edwards, a filesystem is brought from a first “disappearing” volume group to a second “absorbing” volume group, where the second volume group actually absorbs the contents of the

first volume group and where the first volume group is zeroed out or written over (see FIG. 8 and col. 10, lines 27-54 of Edwards).

Nakamura does not overcome any of the deficiencies of Edwards and likewise does not teach or suggest each and every element of amended claims 33-44, taken alone or in combination with Edwards. For example, the Nakamura reference does not teach or suggest creation of a map that identifies one or more separated mirrored copies of data, as recited in amended claim 34. Nakamura instead relates to controlling a paired volume recreation system, where data is copied from a main (first) storage system to a remote (second) storage system, where the main and remote systems require consistency of data between them during the actual copying, and where the consistency must be maintained even if transmission of data during copying is temporarily stopped or suspended (see Nakamura at paragraphs 8-11). To help ensure the consistency, Nakamura discusses using a cache-based system to store pending data writes while data replication between systems is taking place. Although Nakamura does discuss “copying data of a plurality of logical volumes possessed by a first storage system to a second storage system” (para. 11, lines 2-4), Nakamura never teaches or suggests that any one or more of these copies are mirrored copies of the logical volume or that any one or more of these copies can serve as or behave like a mirrored copy. Nakamura also does not teach or suggest that the data copied from the logical volumes also includes related volume information or the same logical configuration.

As explained throughout Applicants’ specification and as Applicants have explained previously in connection with the discussion of the Edwards reference, a mirrored copy is not the same as a regular copy, but is instead capable of being updated when data on the standard volume changes. Nakamura never teaches or suggest any features of its copies that would suggest that they are mirrored copies. For example, Nakamura never teaches or suggests that any of its copies could be updated when or if the original volume changes, which would occur if the copies were mirrored copies. In addition, although Nakamura mentions that there needs to be consistency of data between the main and remote systems (see Nakamura paragraphs 20-22), Nakamura explains that this consistency of data is during the paired volume recreation itself (i.e., the actual act of making the copy itself – see Nakamura paragraphs 6-11 and 20-22), not after the copy has been made. This again supports Applicants’ contention that Nakamura fails to teach or suggest anything relating to mirrored copies.

Nakamura also mentions, in paragraphs 21 and 22, that, prior to the paired volume recreation, its disk subsystem makes a replication of the target volume of copy at the time of putting the system into its suspend status (suspend status exists when a fault occurs during paired volume recreation) to a volume different form the target volume of copy. However, Nakamura never teaches or suggests that this

“replication of the target volume of copy” is a mirrored copy or can serve as or act like a mirrored copy, or has the same logical configuration as the target volume.

Even assuming *arguendo* that some reference or combination of references exists somewhere in the art to describe generally the concept of split/separated mirrored copies (and Applicants note that no such references have ever been cited), Applicants nonetheless maintain that the prior art does not teach creation of the map and all its features, as recited in claim 28, as amended (from which claims 33-44 depend) as explained above, nor does the prior art teach use of the map to create a second volume group on a second computer system having a second operating system, where the logical configuration of the second volume group is substantially identical to the logical configuration of the first volume group and using the map to reconstruct on the second computer system the internal logical volumes and filesystems of the first computer system and mount a duplicate of the one or more volumes on the second computer system.

As Applicants have shown above, Edwards nor Nakamura, taken alone or in combination, do not teach or suggest each and every step of claim 28, as amended, especially the steps of creating a map (including all of the information that the map comprises, as described above and in claim 28, as amended), using the map to create a second volume group on a second computer system having a second operating system, where the logical configuration of the second volume group is substantially identical to the logical configuration of the first volume group; and using the map to reconstruct on the second computer system the internal logical volumes and filesystems of the first computer system and mount a duplicate of the one or more volumes on the second computer system.

In view of the above, Applicants submit that claim 28 is patentably distinct over Edwards and Nakamura, whether taken alone or in combination. Claims 29 to 44 and newly added claims 59-64 depend from and thus include the limitations of claim 28. Thus, Applicants submit that claim 29-44 and 59-64 are patentably distinct over the cited references for at least the reasons discussed above in connection with claim 28.

Claims 45-55 were rejected on the same grounds as the rejections of claim 28 to 44. Independent claim 45 has been amended herein to have limitations consistent with those of claim 28, as amended herein. Accordingly, Applicants submit that claims 45-55 (and newly added claims 66-68, which depend from claim 45) are patentable over the cited references, taken alone or in combination, for at least the reasons discussed above in connection with amended claim 28.

Independent claim 56 has likewise been amended to have limitations consistent with those of claim 28, as amended herein. For at least the reasons already discussed herein in connection with claim

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28, as amended, Applicants maintain that claim 56 (and newly added claims 57 and 58, which depend from claim 56) is patentable over the cited references, taken alone or in combination.

Applicants thus respectfully request that the rejection of claims 28-68 under 35 U.S.C. 103(a) be withdrawn.

In view of the above, Applicants submit that claims 28-68 and the entire case are in condition for allowance. A notice of allowance is respectfully requested.

Applicants do not acquiesce to any assertion made by the Examiner not specifically addressed herein.

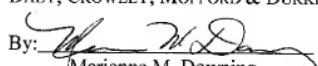
If the Examiner has any questions regarding this Amendment or this application, he or she is respectfully invited to telephone the undersigning attorney.

The Assistant Commissioner is hereby authorized to charge payment of any additional fees associated with this communication or credit any overpayment to Deposit Account No. 500845.

Respectfully submitted,

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